

DISCUSSION OF THE AMENDMENT

The specification has been amended by changing “size” to --sizes--.

The Abstract has been shortened.

Claim 1 has been amended by incorporating the subject matter of Claim 2 therein;

Claim 2 has been canceled.

Withdrawn Claim 14 has been amended by incorporating the subject matter of Claim 15 therein; Claim 15 has been canceled.

Claim 5 has been amended to correct a typographical error.

No new matter is believed to have been added by the above amendment. Claims 1 and 3-13 are now active in the application. Claims 14 and 16-52 stand withdrawn from consideration.

REMARKS

The rejection of Claims 1, 7-10 and 13 under 35 U.S.C. § 102(b) as anticipated by US 6,200,923 (Garoff et al), is respectfully traversed. All of the active claims in this application now contain the limitations of Claim 2, not subject to this rejection. Accordingly, it is respectfully requested that the rejection be withdrawn.

The rejection of Claims 2-6 and 11-12 under 35 U.S.C. § 103(a) as unpatentable over Garoff et al, and further in view of US 5,278,117 (Luciani et al), is respectfully traversed.

As recited in above-amended Claim 1, an embodiment of the active claims herein is a solid component of catalyst for (co)polymerization of ethylene, comprising titanium, magnesium, chlorine, an organo-oxygenated protic compound D_p , and a neutral electron-donor aprotic compound D, in the following molar ratio ranges: $Mg/Ti = 1.0-50$; $D/Ti = 1.0-15$; $Cl/Ti = 6.0-100$; $D_p/D = 0.05-3$, and additionally comprising an inert granular solid, in a quantity ranging from 10 to 90% by weight with respect to the total weight of the solid component.

Garoff et al discloses a composition useful for the polymerization of ethylene, propylene and other α -olefins, which composition contains magnesium, titanium, a halogen and a carboxylic acid ester in a soluble form, wherein "in a soluble form" means that the composition is soluble at least in the synthesis mixture used in its synthesis, in the titanium tetrahalide used in the synthesis, and/or in an organic dissolving substance, such as toluene, used in the synthesis, and which composition has the following formula (I):

$(MgX^3_2)_xTiX^4_a(R(COOR')_n)_y$ wherein X^3 is a halogen, X^4 is a halogen, $R(COOR')_n$ is a carboxylic acid higher alkyl ester containing at least 8·n carbon atoms, wherein R is an n-valent substituted or unsubstituted C_1-C_{34} hydrocarbon group, R' is a C_1-C_{20} alkyl group, and n is a number between 1 and 4, x is between 0.5 and 4, and y is between $0.8/n$ and $2.4/n$. In

formula (I), the molar amount of TiX_4 is basically about 1 (paragraph bridging columns 1 and 2).

Relying on Example 3 of Garoff et al, the Examiner finds that the polymerization catalyst therein meets the molar ratio ranges in above-amended Claim 1. In so finding, the Examiner finds that the EtOH of the $\text{MgCl}_2 \cdot 3\text{EtOH}$ of Example 3 is the same as presently-recited organo-oxygenated protic compound D_p .

In reply, the catalytic composition of Garoff et al does **not** comprise presently-recited protic compound D_p .

First of all, it is emphasized that in the preparation method of the composition exemplified in Example 3 and in Table 3 of Garoff et al, a complex of magnesium chloride and ethanol ($\text{MgCl}_2 \cdot 3\text{EtOH}$) is used with the only objective being to obtain a solution wherein Ti, Mg, electron donor di-undecylphthalate (DUP) and the alcohol originally bound to MgCl_2 are dissolved in toluene.

Such a (liquid) solution cannot be compared to the “solid component of catalyst” of the present invention, especially considering the presence of the inert support according to above-amended Claim 1, not only because a liquid and a solid mixture are different from each other by nature, but also because the advantageous properties of the present solid component derive in part just from the presence of catalytically active sites in the solid structure.

With regard to the solid precipitate of Example 3 of Garoff et al, which composition is described in Table 3, it is observed that EtOH is no more present as such, but as alkoxide bound mainly to Ti (Ti-OEt). Indeed, as described at column 7, lines 43-46: “some ethoxide originated from the reaction of TiCl_4 and $\text{MgCl}_2 \cdot 3\text{EtOH}$.”

Such ethoxide was calculated as ethanol, but no ethanol was present in the solid precipitate, i.e., in the catalyst component (column 9, lines 55-58 and column 10, lines 21-

36). Thus, the description at column 9, lines 55-58: “the product was also analyzed for its ethanol content, which was considered to be derived from titanium trichloride ethoxide..... remaining in the product”, read in combination with reaction (1) at column 10 and the description: “also a small amount of titanium trichloride ethoxide precipitates together with the complex” of column 10, lines 49-50, confirms the absence of a protic component in the precipitate according to Garoff et al.

The above portions add clarity to understanding the chemical process described in Garoff et al. At the beginning EtOH, contained in the complex $\text{MgCl}_2 \cdot 3\text{EtOH}$, reacts with TiCl_4 , which is present in large molar excess ($>10/1$) producing HCl (which leaves in the form of gas) and producing amorphous precipitates (column 10, lines 27-36). The whole is then brought into solution with the DUP donor (column 10, line 40); at the end, when the complex according to the reaction (3) precipitates (column 10, line 47), most of the TiCl_3OEt is removed with the solvent (excess TiCl_4 + toluene/heptane), while “a small amount . . . precipitates with the complex”.

At the moment when the precipitate of the complex prepared according to Garoff et al is formed, EtOH is no longer present, neither in the solution, nor in the complex. When the complex is then analyzed, it is dissolved (as common practice) in the presence of an acid, to identify the elements and the ethoxide group is determined as “EtOH”.

Additionally, according to Garoff et al, the alcohol is introduced prior to the reaction of the “donor” D with Ti and Mg and the possible unreacted alcohol is removed through successive washings (as exemplified in Example 3). On the other hand, according to the method for preparation of the solid component of the present invention, the D_p protic compound is added to a solid precursor already pre-formed.

While the above is sufficient to demonstrate patentable differences over Garoff et al, Applicants have experimentally verified that the addition of butanol according to the process

of Example 1 of the specification herein does not form HCl in a significant amount.

Therefore, unlike Garoff et al, the solid component according to the present invention comprises a D_p protic compound in its composition. Moreover, during a second experiment, it has been demonstrated that the amount in moles of donor D removed from the solid during step d) of preparation of the catalyst, as recited in withdrawn process Claim 14, stoichiometrically corresponds to the amount in moles of D_p introduced into the solid.

Presumably, such an exchange significantly and surprisingly deforms the structure of the solid in an advantageous manner, allowing achievement of the desired objective, namely a higher activity of the catalyst and the formation of polymers and copolymers of ethylene with high molecular weight and low stickiness, such as to be easily produced in fluidized bed gas-phase processes, up to a density of 0.900 g/ml.

To the contrary, with the traditional catalysts of the known art, including the catalysts disclosed in Garoff et al, it is observed that the fluidized bed easily aggregates and collapses when one attempts to obtain LLDPE with a density lower than 0.915 g/ml.

The present invention represents therefore a great improvement over the known art, which achieves production, in a gas-phase process, of a LLDPE with quite low densities without incurring the drawback of a heavier fluidized bed due to stickiness of the polymer. Said advantageous behavior has been analyzed, as described in detail in the present specification, from page 6 to page 7 and outlined in practice in Examples 7 to 14, compared to Comparative Examples 15 and 16 and still more in Examples 17 to 23 compared to Example 24, as described in Table 3.

In said Table 3, examples for preparation of co-polymers of ethylene to obtain VLDPE with densities lower than 0.915 g/cm³ are described. Said linear polyethylenes with very low density, very useful in a filming process, are hard to prepare through gas-phase processes that use traditional catalysts, due to the polymer having a high tendency to

aggregate, as demonstrated by Comparative Example 24, wherein it was not even possible to complete the process due to the drop of the fluidized bed. Surprisingly, using a catalyst obtained with the simple addition of a D_p protic donor according to the present invention, it has been possible to obtain said VLDPE in gas-phase with good yield and excellent properties.

On the other hand, Garoff et al is directed to obtaining a catalyst for the polymerization of olefins, in particular of propylene, as clearly outlined in Figures 1 and 2 thereof. The problem faced by Garoff et al is obtaining a soluble polymerization catalyst, such as to be easily distributed in the form of a solution (column 1, line 60 to column 2, line 5).

Garoff et al neither discloses the problem addressed by the present invention nor Applicants' solution. Garoff et al neither discloses nor suggests the convenience of operating with a solid component, since Garoff et al is drawn to a soluble catalyst that may be easily brought into solution and used in such a form. Nor does Garoff et al disclose or suggest any reason to include a second donor component of the protic kind in the their catalyst.

Luciani et al is relied for the disclosure of an inert support, but does not remedy the above-discussed deficiencies of Garoff et al because it discloses and suggests nothing with regard to the presence and role of said D_p protic compound.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

In addition, the above-discussed argument with regard to the disclosures and deficiencies of Garoff et al provide further evidence that Garoff et al does not support a finding of lack of unity of invention herein. Indeed, the Examiner has erroneously relied on Garoff et al in finding that Groups I-IV do not share a special technical feature. Accordingly, it is respectfully requested that the Restriction Requirement be withdrawn and all pending claims be examined.

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Reply to Office Action of April 15, 2010

The objection to the Abstract of the Disclosure is now moot in view of the above-discussed amendment. Accordingly, it is respectfully requested that the objection be withdrawn.

All of the presently-pending claims in this application are now believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

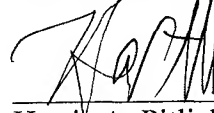
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